DISCUSSION BEFORE THE WIRELESS SECTION, 24TH NOVEMBER, 1943

Dr. R. L. Smith-Rose: This paper represents an achievement on the part of several individuals and establishments. It is a very great credit to the author, the Air Ministry and the Wireless Section of this Institution that this paper has been presented. During my year of office as Chairman arrangements were made, through the good offices of Sir Noel Ashbridge and Air Vice-Marshal V. S. Tait, for Mr. Edwards to prepare this paper. After its completion, there were difficulties and some delay in its release. These were due, not to the fear that the information it contained would convey anything new to the enemy, but to the fact that our authorities did not wish the enemy to know how expert we are in reconstructing their damaged apparatus.

Any designer of radio apparatus must be struck by the expert nature of the equipment itself, particularly its suitability for mass-production manufacture. It is noteworthy that the medium-wave receiver and the transmitter use only two types of valve between them. The attention of receiver and valve manufacturers should be drawn to this point, since before the war we were embarrassed with 400 or 500 different types of receiving valve in this country. I gather that other parts of the equipment, e.g. components, show signs of similar standardization.

I should like to ask the author if the assembled apparatus shown represents all the equipment found in either the bomber or fighter type of aircraft. Particularly, has the author any knowledge of cathode-ray equipment which may be used for special beacon or direction-finding purposes? It is useful to know whether such equipment has ever been discovered, not necessarily in either bomber or fighter aircraft, but in certain special aircraft.

References to frequency and wavelength seem to be a little confused in the German mind as well as in our own. Although the dials are calibrated in frequency, the data on them are given

in terms of wavelengths, indicating that the German, too, cannot decide whether he wants frequency or wavelength.

Mr. C. S. Cockerell: It is very interesting to look at the construction of these sets, bearing in mind previous sets made in Germany before this apparatus was produced. A gradual evolution is evident. Very early on die-casting was used for certain assemblies, the chassis being made of angle or sheet, and then gradually the design became more and more compact, eventually reaching the present layout. The final design has been evolved gradually, and differs from the product of any other country in the world. It is not necessarily better than that of other countries when the obviously greater number of man-hours and the skill required both for its construction and repair are taken into account.

Has the author any data for temperature rise in this very compact construction, say in the transmitter?

Does the author consider the splitting-up of this equipment into so many separate units—for instance, the transmitter with its two bands into five large units—is the right method of designing, or does he not think that the method adopted by other countries, which is to put more facilities in any one unit, is a better arrangement?

Mr. J. Moir: It would be interesting to know whether some representative samples of this apparatus could be distributed to manufacturers of equipment. Many people, particularly production engineers who are not members of this Institution, are interested, and it would be useful for them to see this equipment.

Have any tests been made to see how this equipment would comply with our specifications? In particular, have any tests been made in tropical chambers? The capacitor sizes seem remarkably small for the capacitances marked on the cases. There seems to be no impregnation on the coils. Is it well concealed by the outer wrapping? Have our component manufacturers any remarks to make on the small size of the components?

Mr. S. N. Ray: Is additional temperature compensation provided with the copper-on-ceramic inductors? The carbon-track resistors are presumably the high-stability type where the deposit is fired at a high temperature.

Mr. T. D. Conway: From a production aspect the die-casting construction on this set is very satisfactory, and it is interesting that the Germans were using it in 1935. Yet it appears to make modifications impossible and much flexibility of design is lost.

Wing-Commander P. Allerston: When discussing the electrical equipment of aircraft, air crews often ask why they have no power-operated aerial winches. Will the author say whether it is because of the need for restriction on the power supply?

The author says that German laryngophones have been thoroughly tested in this country for articulation efficiency on both words and syllables, and that they do not compare very favourably with microphones of either carbon or electromagnetic types mounted in the oxygen mask. But the question is whether this is attributable to the peculiarities of the German utterance as compared with our Anglo-Saxon tongue, or merely to the fact that the positioning of the laryngophone is so difficult that the ordinary member of an air crew cannot wear it for more than a few minutes. I suggest that the English language, being more sibilant than the guttural German tongue, is not adapted to the laryngophone.

Is it not a fact that the German policy in set design is largely influenced by their inability to obtain stocks of crystal quartz?

Mr. C. E. Strong: The German communication equipments are remarkable for the unification of thought applied throughout, both in regard to construction and technique. It would be interesting to know if the sets were envisaged simultaneously or if the basic ideas were regarded as so satisfactory that they were applied in sets designed successively.

The question is of special interest in regard to the method of frequency control and frequency adjustment adopted, characterized by the avoidance of crystal control and the use of the whistling-in system. Is there any sign of dissatisfaction with that method, and of a later tendency to avoid the necessity of whistling-in by attaining the requisite standards of frequency stability and setting accuracy? They have in general restricted the frequency bands covered to a two-to-one ratio or less to avoid complications, and it is surprising that having so far simplified their problem they did not design for the setting accuracy requisite for the independent frequency adjustment of sets.

Mr. H. Horwood (*communicated*): I wish to stress the need for simplicity and reliability in the design of electrical equipment on aircraft. This is probably more necessary in war time than in peace, since many air crews have not had the advantage of long flying experience. The electrical designer should therefore make a drastic change in his safety and reliability factors. It is not always possible to make a machine failure-proof, especially when weight and space have to be taken into account. Efficiency is important, but reliability must loom larger in the mind of the designer. Similarly, simplicity of operation is imperative to permit rapid action in an emergency.

Mr. T. Kearns (*communicated*): The author states that no outstanding advantage can be claimed by either side in regard to bomber equipment. Presumably this is from the point of view of performance, and if so it would be interesting to know if this comparable performance is obtained, with similar total weights of radio equipment and interconnectors, a factor obviously important in aircraft.

The emergency wire-cutter on the German aerial winch would appear to be an unnecessary refinement unless the winch is inaccessible for hand-jettisoning purposes. Apparently there is no lightning-discharge device on the trailing-aerial apparatus; does the author consider such a device necessary?

The intercommunication fixed-wiring in the German aircraft is apparently unscreened; this circuit in aircraft is very susceptible to interference, being so extensive. Does the author consider it more satisfactory to have it totally unscreened rather than risk trouble with screened cables not having the outer sheath in good contact with the metal airframe throughout the aircraft? Particulars of the type of German intercommunication cables and the method of attachment to the airframe would be of interest. I have assumed an all-metal aircraft as normal, but it is apparent that the increasing use of non-metal airframes will require modifications to what is considered standard British practice, which can be said to screen as much as possible of the radio equipment and interconnectors; to ensure good electrical contact between the airframe and all-metal articles of any appreciable size; and to incorporate suppression devices in the power supply to all aircraft contacts continually sparking or apt to do so. Apart from screening, is German practice on similar lines?

Do the thermal-overload circuit-breakers in the supply to the German power units furnish any advantage over the normal totally-enclosed fuse?